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ABSTRACT

An audio-tutorial approach that has been implemented at Indiana University in Bloomington focuses on student learning rather than the mechanism of teaching. The basic component of an audio-tutorial course is a taped presentation that acts as a tutor, guiding the students through a sequence of readings, filmstrips, diagrams, tables, and other media. The tape is not simply a recorded lecture; the students are frequently directed by the tape to stop and analyze materials, plot data, examine a filmstrip, apply principles, and discuss conclusions. An instructor is always present when the tapes are being used. Use of the audio-tutorial laboratory in zoology, microbiology, and geography classes is discussed. The most important advantage of the approach is that it allows procedures for specific techniques to be given to students on an essentially individualized basis when the student is ready for them. In the microbiology course, the audio-tutorial approach also became an integral part of the evaluation process. (SW)

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# EXPERIMENTS WITH AUDIO-TUTORIAL LEARNING SYSTEMS AT I.U.B.

Indiana University - Bloomington

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Many faculty members are searching for alternative strategies that engage large numbers of students with different backgrounds and interests. The audio-tutorial approach offers one way for students to make decisions about their learning and to work at their own pace. The extensive planning and equipment that are necessary to mount such a program give pause to many, but several faculty throughout the University system have invested the time and found the funds to build such a laboratory or learning center. Among them are George Hudock in Zoology, W.A. Konetzka and Allan Williams in Microbiology, and Robert Kingsbury and Alan Backler in Geography, all of whom are on the Bloomington campus.

The foundation of the audio-tutorial approach is its accent on student learning rather than on the mechanism of teaching. Professor Samuel Postlethwaite of Purdue University, one of the pioneers in the field, has pointed out that audio-tutorial instruction "involves the teacher identifying as clearly as possible those responses, attitudes, concepts, ideas, and manipulatory skills to be achieved by the student and then designing a multi-faceted, multi-sensory approach which will enable the student to direct his or her own activity to

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attain these objectives."

The basic component of an audio-tutorial course is a taped presentation which acts as a tutor, guiding the students through a sequence of readings, filmstrips, diagrams, tables, and other media. The tape is not simply a recorded lecture. The students are frequently directed by the tape to stop and analyze material, plot data, examine a filmstrip, apply principles, and discuss conclusions. An instructor is always present when the tapes are being used. Thus, an effort is made to create an active rather than a passive learning environment.

The concerns which gave rise to Professor Hudock's development of the audio-tutorial laboratory in Zoology are not unlike those that troubled his colleagues in Microbiology and Geography. In 1970, Professor Hudock became aware of changes in the enrollment patterns of Z366, the former genetics laboratory course, which made it necessary to develop a new approach in Z450, Genetics Laboratory. Whereas in 1965 a majority of the 37 students enrolled were graduate students, in 1970 a majority of the 140 students enrolled were undergraduates. In addition, Professor Hudock and his assistants were spending so much time preparing materials for the lab and repeating explanations to students that they were teaching very little genetics. He plotted the degree of error in one particular experiment as a function of enrollment and obtained a linear relationship. Extrapolation suggested that accurate results with the teaching approach they were then using could be obtained with an enrollment of not more than 20 students.

In the fall of 1971, therefore, Professors Hudock, John Preer, and Rollin Richmond began to develop an audio-tutorial system which would be an effective approach in teaching large numbers of students. In laboratory sections designed for 20 persons at a time, students now listen to the recorded direc-

tions and view related slides. Students refer to as many or as few other aids as they require to understand the concepts. Students work individually in carrels equipped with a tape deck with headphones, a slide projector, a compound microscope, a dissecting microscope, and materials which pertain to a particular section of the course.

Within the limits imposed by the study of biological materials, the students have obtained excellent results. There has been a change in Professor Hudock's role in the lab; he is no longer a "troubleshooter." Now when he visits the lab daily he can discuss the experiments in detail and can become acquainted with the students as people. In addition, Associate Instructors are available at all times and are able to know the students, meet their needs, and evaluate their work accurately. Very favorable student response to the course is indicated by the Audio-Visual Center evaluations.

In Microbiology the initial concerns in the development of an audio-tutorial lab were somewhat similar. Professors Konetzka and Williams found considerable variation in student response to the traditional laboratory in Microbiology Laboratory, M255. One section of students would express high praise for the laboratory, while another would regard it as worthless. The content was obviously the same, but the Associate Instructors differed. Essentially, they hoped the audio-tutorial approach would guarantee each student the same kind of instruction. In spite of a rather primitive initial effort of adapting the exercises from the traditional laboratory to the audio-tutorial approach, the students' responses were overwhelmingly favorable. Encouraged by these responses, Professors Konetzka and Williams decided that the audio-tutorial approach necessitated a complete rethinking of the content of the laboratory and of the strategems for instructing and evaluating students.

To determine what the content of an introductory laboratory should be,

they examined the content of introductory laboratories in Microbiology by collecting the table of contents of hundreds of la_ ratory manuals published over a number of years and their own departmental efforts over the past 15 years. They were able to discern at least five different overlapping categories of laboratory approaches which might be labelled: the fact-learning type, the discussion-exhibit type, the technique-learning type, the problem-solving type, and the experimental type. Most laboratory courses, no doubt, could be classified into one of the categories by their primary emphasis and approach; but they would invariably contain some aspects of the other categories. After reviewing the content of various introductory laboratories, discarding redundant exercises, and carefully analyzing the kinds of information contained in the remaining exercises, Konetzka and Williams polled the faculty on what skills, concepts, knowledge, etc., they expected to be brought to advanced courses. They concluded that this laboratory would have to be designed as the technique-learning type. Not only was the question on content answered by their comprehensive analysis, but it also revealed that the audio-tutorial approach offered several advantages for this type of laboratory which the traditional approach did not.

The most important advantage of the audio instructions, video tapes, film loops, etc., is that it allows procedures for specific techniques to be given to students on an essentially "individualized" basis when the student is ready for them. In the traditional laboratory, the demonstration of techniques are invariably given to everyone at the beginning of the laboratory period long before they are actually used or at some time during the laboratory period when students are at different stages in the exercise.

In subsequent semesters, Professors Konetzka and Williams attempted to examine each phase of the laboratory in order to improve the instructional as-

pects - visual material, video tape demonstrations, script improvements, the purpose and format of discussion sections, etc. They also experimented with ways of using audio-tutorial techniques to improve the evaluation of student performance, although that matter was recognized very early as a source of serious difficulty. Experience with written examinations indicated that students who never came into the laboratory could perform well by studying and understanding the reading material and experiencing demonstrations in the lecture course. Practical laboratory examinations of the classical type also proved ineffective. After discussion with Associate Instructors, learning objectives were specified; and two types of lab experiences - Open Practicals and Scheduled Practicals - were decided on as the main measures of student performance.

The Open Practicals focus on techniques which are essential for more advanced procedures. Within certain time limits, the Open Practicals are available anytime a student feels proficient in a specific technique, such as aseptic transfer, streaking plate, aseptic pipetting, and others. Evaluation results are given immediately. If the performance is unsatisfactory, explanations are provided. Practice is required before the student attempts the "examination" a second time. The Scheduled Practicals, which are available only at specified times, require applications of the various techniques learned in the Open Practicals. While continuing to refine their methods for grading practicals, Konetzka and Williams have not dispensed with the usual examinations, which are now used to determine whether a student who may have performed well on a particular technique is able to recognize the implications or ramifications of this work.

Thus, in Microbiology, the audio-tutorial approach not only forced a re-examination of traditional methods of evaluation, but it also became an inte-

gral part of the evaluation procedure. The audio-tutorial approach allows large numbers of students an opportunity to improve their skills by "individualized" instruction when they require it. Such an undertaking in the traditional laboratory is an almost impossible task.

Prior to the establishment of audio-tutorial laboratories in Zoology and Microbiology, Professor Robert Kingsbury began experimenting in 1966 with the audio-tutorial system in G235 (Map and Aerial Photo Analysis). Encouraged by the high degree of student acceptance, superior achievement in the testing program (as compared with results from the previous lecture method), and an evaluation completed by an educational media specialist, he introduced the system in a second course, G341 (Geography of South Asia), in 1967 and in a third course, G107 (Physical Systems of the Environment), in 1968.

The 325 students now enrolled in G107 are engaged not only in independent learning, but also in group discussions and peer instruction. The 14 weekly taped presentations make use of a set of integrated study experiences which include readings, color filmstrips, aerial photos, relief models, typographic maps, and meterological equipment. The study guide for each lesson sets forth the learning objectives, an outline of the taped presentation, and review questions.

Professor Alan Backler's audio-tutorial course in G110 (Human Geography), supplements the taped presentation with weekly discussion groups, games, and other activities. The most distinguishing feature of this course, however, is the comprehensive evaluation of the audio-tutorial system. First, the students fill out an evaluation of the tape presentation before leaving the learning center each week. The results of these evaluations are then used to restructure the tape presentation.

During the semester, a telephone interview is also administered to a

sample of students stratified on the basis of exam grades. This evaluation is used to establish the relationship between test scores and various learning procedures incorporated in the course (for example, reading objectives before starting tape, repeating portions of the tape, performing tasks suggested by the tape, interacting with the learning center instructor). The results of this evaluation are also used in restructuring the entire course.

Finally, an overall evaluation of the course is done at the end of the semester. The purpose of this evaluation is threefold: to determine students' general reactions to the audio-tutorial technique; to see how the students perceive and understand the relationship between the Introductory Phase of the course in which they learn geographic concepts and skills and the Analysis Phase in which they analyze a "real world situation" in terms of the concepts and skills learned in the first phase; and to see whether the students and the course developers shared a common understanding of the purpose of the Analysis Phase. Professor Backler is now developing a procedure for evaluating learning center instruction and discussion-group leader behavior.

Professional expertise from the Division of Development and Special Projects of the Audio-Visual Center is available to faculty members who wish to develop audio-tutorial courses. The services of this Division, under the direction of Professor Tom Schwen, are offered to faculty without cost. In the development of his laboratories in Zoology, for example, Professor Hudock worked with Ed Green of the Audio-Visual Center and the undergraduates who had taken Z366 the preceding semester in refining and improving the course as it evolved. After developing the original version of G110 himself, Professor Backler worked with Professor Schwen to develop and restructure (1) specific behavioral objectives for each of the weekly lessons (which includes a tape presentation and a discussion session); (2) learning sequences so as to

reflect these objectives; (3) techniques for evaluating the students' ability to perform the objectives; and (4) means of evaluating the course.